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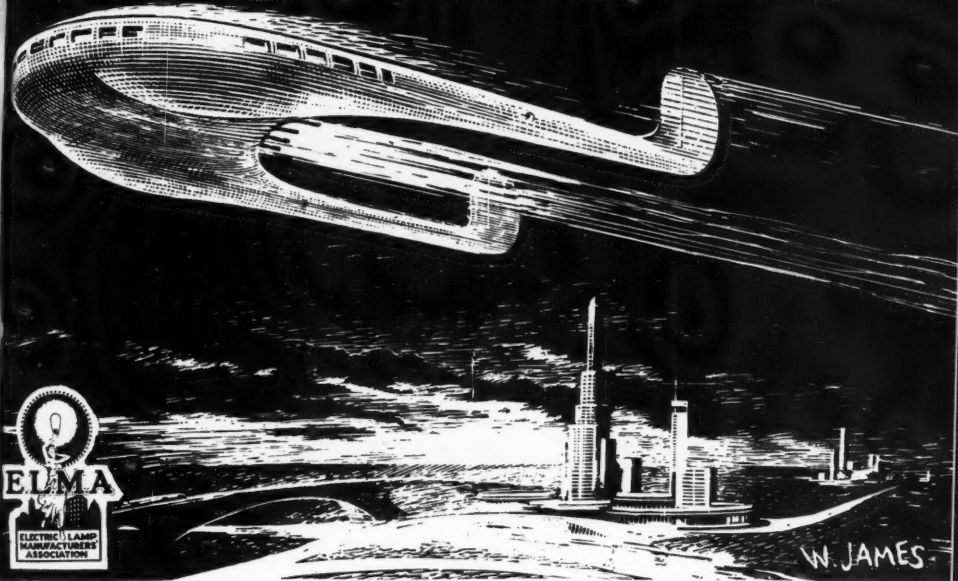
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January, 1944

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LIGHT AND LIGHTING

32, Victoria St.,
London, S.W.1.

Edited by J. STEWART DOW

Telephone:
ABBey 5215

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January—December, 1944

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Engineering
Society.

Incorporating
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When The Lights Go Up Again

THE recent tests in Deptford, where, for a brief interval just before black-out began, normal lighting in one street was restored, naturally excited much local interest — especially among the children, many of whom had never seen a pre-war street lamp in operation, and to whom this splendour was a wonder indeed.

Whilst it may be some time yet before even modified street lighting, as understood in pre-war days, can be permitted, we should like to see Authorities trying out their systems, reviewing their stock and making good where defects and imperfections exist.

Sage advice on this point was given not long ago by Mr. E. J. Stewart, in his address to the Association of Public Lighting Engineers. There are, we know, some public lighting engineers who have already made preparations for the better times to come. But there are others who have doubtless still much to do, and others again whose systems have been damaged past repair and for whom completely new installations may be necessary.

It is none too soon to begin the work of restoration and consider the placing of orders for the time when The Lights Go Up Again.



Lectures to School Children in Bradford

We hope later to give a fuller account of the lectures to school children in Bradford, given by Mr. R. O. Ackerley during the Christmas holidays. This new departure seems to have been most successful; other Centres and Groups will doubtless take note of the event, which might well be repeated elsewhere. We understand that the talk was given six times (three times on two successive days) to an aggregate of something like 1,400 children, and that over 100 teachers were included in the audience. A good feature was a nicely got up and illustrated card on "Things to Remember about Your Lighting," copies of which were presented to every child attending. It was undoubtedly a fortunate circumstance that Mr. Ackerley was induced to undertake these lectures, which he delivered in his inimitable way, and that Mr. W. R. Stevens was also on the spot to assist him with various slick but simple demonstrations. Great credit is also due to the Bradford Group for their enterprise in initiating this scheme, and especially to the chairman (Mr. Naylor) and the secretary (Mr. Hutchison), who spent a considerable amount of time and effort in making the preliminary arrangements.

Examinations in Illuminating Engineering

The editorial on this subject in our last (December) issue has led to several applications for information on the examinations conducted by the City and Guilds of London Institute. We shall be very happy to send further copies of the leaflet, prepared by the I.E.S., to any members interested. After the war there will doubtless be a more widespread demand; in present circumstances the number of entries has naturally been limited—but there must still be many of the younger I.E.S. members who could take the examination and would find it advantageous to do so.

A "Footcandle Bonus"

Under this title Mr. Earl W. Fowler, in "Illuminating Engineering," reports on two office installations, otherwise similar except that in one case lighter colours were adopted for the decoration of surroundings—with the result that the utilisation factor was improved, and a gain in light of over 15 per cent., a genuine "footcandle bonus," was secured. Much more is likely to be heard in the future of the value of light surroundings—not only walls and ceilings, but floors, furniture, and parts of machines. Even more important than the gain in illumination is the visual effect—but here the distribution of brightness and the attainment of "brightness equilibrium" furnishes another field for study.

Forthcoming I.E.S. Meetings

(Provisional List)

SESSIONAL MEETINGS IN LONDON

1944.

Feb. 14th. Address by THE PRESIDENT (DR. H. BUCKLEY) on **18th Century Contributions to Photometry and Illuminating Engineering.** (Sessional Meeting to be held at The Royal Institution, Albemarle Street, London, W.1.) **5 p.m.**

Mar. 14th. MR. J. B. CARNE on **The Lighting of the Homes of Tomorrow.** (Sessional Meeting to be held in the House of the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.) **5.30 p.m.**

MEETINGS OF CENTRES AND GROUPS

1944.

Feb. 10th. DR. W. J. WELLWOOD FERGUSON on **The Eye.** (Meeting of the Bradford Group, to be held in the Electricity Showrooms, Sunbridge Road, Bradford.) **6.45 p.m.**

Feb. 10th. MR. W. BROWNING on **Reflections** and MR. A. H. OWEN on **Home Lighting and Decoration.** (Meeting of the Manchester Centre, to be held at the College of Technology, Sackville Street, Manchester.) **2.30 p.m.**

Feb. 18th. Address by THE PRESIDENT (Meeting of the Glasgow Centre to be held at the Lighting Service Bureau of Scotland, 29, St. Vincent Place, Glasgow.) **6 p.m.**

Feb. 25th. Short Papers forming a **Symposium on Lighting.** (Meeting of the Birmingham Centre, to be held at the Imperial Hotel, Temple Street, Birmingham.) **6 p.m.**

Mar. 2nd. Address by THE PRESIDENT. (Meeting of the Newcastle Centre, to be held in the Minor Hall, Oxford Street, Newcastle-on-Tyne.) **5.30 p.m.**

1944.

Mar. 6th. Address by THE PRESIDENT. (Meeting of the Bath and Bristol Centre, to be held at the Grand Hotel, Broad Street, Bristol.) **7 p.m.**

Mar. 6th. MR. J. S. PRESTON on **Photoelectric Photometers.** (Meeting of the Leeds Centre, to be held in the Leeds Corporation Electricity Showrooms, The Headrow, Leeds.) **5.15 p.m.**

Mar. 6th. MR. R. GILLESPIE WILLIAMS on **The Poetry of Light.** (Meeting of the Sheffield Centre, to be held in the Central Library, Sheffield.) **6 p.m.**

Mar. 7th. MR. R. MAXTED on **Infra-Red Radiation.** (Meeting of the Derby Group, to be held in the Derby Electricity Showrooms, Irongate, Derby.) **6 p.m.**

Mar. 9th. A Paper on **Neon Signs in Post-War Years.** (Meeting of the Bradford Group, to be held in the Bradford Electricity Department Showrooms, Sunbridge Road, Bradford.) **6.45 p.m.**

Mar. 9th. PROFESSOR PICKEN on **Ultra-Violet Rays and their Effect on Micro-Organisms.** (Meeting of the Cardiff Centre, to be held in the Cardiff Corporation Demonstration Theatre, The Hayes, Cardiff.) **3 p.m.**

Mar. 9th. DR. W. J. WELLWOOD FERGUSON on **Visual Functions and Illuminating Engineering.** (Meeting of the Manchester Centre, to be held in the College of Technology, Sackville Street, Manchester.) **2.30 p.m.**

Mar. 24th. MR. A. J. MADDOCK on **The Thyration and some of its Applications.** (Meeting of the Birmingham Centre, to be held at the Imperial Hotel, Temple Street, Birmingham.) **6 p.m.**

Mar. 24th. MR. A. L. RANDALL on **Fluorescent Lamps and their Applications.** (Meeting of the Glasgow Centre, to be held at the Lighting Service Bureau of Scotland, 29, St. Vincent Place, Glasgow.) **6 p.m.**

Mar. 24th. DR. S. ENGLISH on **Light Control of Glassware.** (Meeting of the Nottingham Centre, to be held in the Lecture Theatre of the City of Nottingham Gas Dept., Parliament Street Nottingham.) **5.30 p.m.**

Secretaries of Centres and Groups are requested to send in, as soon as available, particulars of any modifications in or additions to the revised List of Meetings for the Session as reprinted, in revised form, from the Transactions (December, 1943).

Lighting of Welding Shops

by M. W. HIME, A.M.I.E.E., F.I.E.S.

(E.L.M.A. Lighting Service Bureau
of Scotland)

The lighting of welding shops merits attention from illuminating engineers. Information on this problem, which is a somewhat special one, is scanty. Whereas the usual aim of the illuminating engineer is to provide lighting which ensures good visibility, in the welding shop the main problem is the elimination of the multiplicity of flashes from the welding machines. Cases of eye trouble attributable to the process of welding are still reported by factory inspectors. It is therefore suggested that the problem might be successively examined on the following lines:—

- (1) The newly-formed Committee on Physiology of Vision might investigate the subject.
- (2) The I.E.S. might make recommendations.
- (3) Special legislation, governing lighting in welding shops, might be introduced at some future date.

General Comments

Whilst works engineers usually welcome advice from lighting experts in regard to machine bays, it is often assumed that in the welding shop "enough light is produced by the workers themselves." The lighting, therefore, not infrequently consists merely in a few low-wattage fittings haphazardly installed in the vicinity of the work. Now modern methods of production involve a considerable amount of welding, and there is great variety in the nature of articles treated and the material used. Hence it is difficult to formulate precise rules—and yet the problem will become increasingly important as more and more plant is handled in the welding shop. It may

therefore be well to review the types of layout adopted in different shops.

Layout of Welding Shops

There are, of course, a number of distinct welding processes. Spot welding shops do not usually present many difficulties. A reasonably high illumination on the work is necessary so that the operator may see the exact position of the metal to be welded. From time to time the eyes of the spot-welder are subjected to flashes, but, as a rule, not of a very injurious nature. In difficult cases a suitable "sighting screen" serves to protect the worker's eyes from overstrain.

The trouble arises mainly in connection with butt welding and other forms requiring electrodes, but also in some forms of oxy-acetylene welding. Electrode welding processes involve a great deal of repetition work. It is usual for each welder, with his machine, to have a separate cubicle, made of some fire-proof material and almost invariably painted black. In some cases the welding shop is a distinct unit, but in others the welding machines are on one side of the bay, whilst on the other side workers are marking out plates or similar material which passes directly to the welding area. In yet other cases overhead cranes are used to bring the plant requiring treatment into the welding area. It will be understood, therefore, that conditions vary greatly and may demand different solutions.

Accidents in Welding Shops

Apart from general accidents, such as might occur in any welding shop, there are three types directly attributable to kind of work done:—

- (a) Injury to eye due to splashing of molten metal or electrodes.
- (b) Injury to eye due to exposure to flashes of light from welding machines.
- (c) Burning.

Evidently the use of goggles is the main precaution to be taken in connection with (a). The work of the illuminating engineer can, however, aid materially in connection with (b) and (c)—e.g., by providing conditions which

reduce the manipulation of goggles to a minimum. At present, when a weld is completed, workers commonly push up their goggles in order to inspect it, and in so doing incur the risk or risks from flying molten metal or from flashes.

The phenomena associated with such injuries (b) are somewhat complex. Eye trouble occurring in testing departments following a sudden flash from a circuit breaker or fuse is often attributed to the high percentage of ultra-violet light generated. It should not be overlooked, however, that the effect of sudden exposure to very bright visible light quite close to the eye may in itself be detrimental—especially in view of the fact that the eye is adapted to a low order of brightness. In this connection the case of the crane-driver deserves special consideration. Situated in his cabin some 15 ft. above floor level his eye is naturally adapted to a very low order of brightness; yet he is subjected to every flash from each individual machine throughout the shop. It is no wonder, therefore, that crane-drivers are amongst those most prone to suffer from this source of eye trouble.

Subjects for Further Investigation

The following points seem to deserve further investigation:—

(a) In the case of electrode welding what is the average brightness of the arc produced? Is it a variable with the type of electrode, and with the type of material?

(b) What is its spectral composition? Is its effect due mainly to brightness? And how is it related to (a), (b), and (c)?

(c) What is the order of local illumination produced?

(d) What colour of surroundings achieves the best result in diminishing the effect of a flash?

(e) What level of illumination is desirable in the vicinity of the work and how can this best be obtained?

Some of these questions are relatively simple, others will require further investigation.

Some Tentative Suggestions.

From the experience at present available there are four suggestions that can be tentatively offered:—

(i) Any lighting introduced into a

welding shop has generally been from direct lighting equipment providing a certain illumination on the horizontal plane. Whilst this is necessary for inspecting the weld afterwards, the values generally adopted appear to be far too low and about 15 f.t.c. on the horizontal plane is required.

(ii) The brightness of the ceiling and walls is of paramount importance. In order to counteract the effect of a flash the brightness of the ceiling and adjacent walls should be increased; not only must a horizontal level of a high order be available but arrangements should be made to "upturn" some of the fittings in order to produce a high brightness ceiling. Furthermore, in difficult cases walls near adjacent welders should be treated like posters and lit by means of angle reflectors, increasing the field brightness. A combination of these suggestions might meet all the conditions arising in any welding shop layout. Certainly the superimposition of the welding flash would not be anything like as noticeable to the observer's eye at ground level.

(iii) The present practice of painting welding interiors black is fallacious, not only does it absorb a certain amount of light, but the psychological reaction due to the undue contrast presented in the modern welding shop is totally incorrect. The black portions should give way to either a battleship grey or a green tint having a reflection factor of some 40 per cent., so far as the cubicles and side walls are concerned.

(iv) If the above measures were adopted, in many cases it would be possible to modify the opacity of the present glass used in goggles and head shields so that the operative would not be unduly worried when welding. The intensity of light falling on the article being welded would also be sufficient to allow him to inspect the weld without removing his goggles. This would obviously diminish fatigue on his eye, and the possibility of injury from flying molten metal would also be reduced. Furthermore, the installation of the right quality of light would enable workers marking out plates, etc., to carry out their job with the minimum of fatigue and accidents, and the maximum production would be obtained.

Architectural Lighting

Summary of an Address prepared by Mr. Percy Thomas, President of the R.I.B.A., for delivery to the I.E.S. Cardiff Centre.

As Mr. Percy Thomas, the President of the R.I.B.A., was unable, owing to indisposition, to attend the meeting of the Cardiff Centre, arranged for December 2, in order to deliver his address, this was read by Professor T. David Jones, and was heard with great interest by those present.

Mr. Percy Thomas reminded the audience that the architect has two main tasks in any lighting scheme, firstly to ensure adequate lighting conditions in a general sense (enough light, absence of glare, suitable distribution, etc.), and secondly to determine the system of lighting to be used—i.e., whether to use "fittings" or to adopt some system which is part of the structure.

Co-operation at an Early Stage

Both methods may vary within wide limits, and this is the point at which the architect and the lighting engineer should come together. Sometimes the lighting expert only comes in after the structure is built—with the result that the architect has to put in more points than were provided for in his design, or to get more candle-power into his fittings, which therefore do not suit the design originally visualised. Indirect lighting must receive consideration at an early stage, so that coves, ceiling recesses, etc., can be designed in relation to the illumination required. Architects will probably be much interested in indirect lighting during the post-war years, for the tendency in modern design is to make the lighting system an integral part of the building.

American Practice

The trend of events in America, which often gives a lead in these

matters, is of special interest. In this connection Mr. Thomas described some of the arrangements in the newly-erected Statler Hotel in Washington—in which practically every form of light distribution is applied, the system being designed as part of the ceiling treatment in all the principal rooms. Discharge lamps (operated on a high voltage furnished by transformers) are largely used, with both plain and fluorescent coated glass. The lighting is very effective with an absolutely smooth spread of light. In other rooms concealed sources illuminate walls and ceilings, and are operated by dimmers. In the hotel guest-rooms there is a departure from the customary furniture, a single unit serving for bureau, desk, and dressing table. Bedside tables have built-in radio, a combined telephone, and lamp standard, and built in ash trays. There is no ceiling light, but a standard lamp near the sitting space. Bathrooms have built-in fittings.

The Design of Fittings

There is much to be done in the design of fittings, which architects usually desire to harmonise with the treatment of the room. The Swansea Civic Centre and the Temple of Peace at Cardiff are instances in which the fitting forms an integral part of the design. In this field greater co-operation between the architect and lighting firms is needed. Architects may often want shapes and designs that do not lend themselves to efficient lighting—though it cannot be said either that appearance is everything or that efficient lighting should always have preference over appearance. In most cases consultation should enable both requirements to be met and faults such as "spottiness" avoided. Different types of glass should also be studied. Architects dislike the ordinary opal, but other forms are frequently not sufficiently obscuring to hide the lamps behind. All units in halls and similar



CORRECT LIGHTING is an extra eye



WHEN eyes have to be "everywhere at once"—as they need to be on so many jobs—a third eye would be immensely valuable. Unfortunately, nature consistently refuses to provide more than two eyes. But workpeople can be given perfect seeing conditions, and that is often as good as an extra eye.

EASY SEEING CURBS WASTE—

People who have not made a study of lighting are sometimes difficult to convince that correct lighting makes an enormous improvement in working conditions and output. But in factories where careful tests have been made it has been established that improved lighting has sent output up by as much as 25%. Furthermore, there is evidence that "good seeing" reduces accidents—accidents to personnel, materials, and machinery—also, by eliminating strain, reduces the number of workers absent through minor ailments.



— AND RAISES EFFICIENCY

In good light—which is fitness-for-purpose light—a worker's interest is sustained; because he or she does not suffer from premature fatigue. Manual dexterity is increased; reactions are quicker; the whole standard of efficiency improves. Particularly where trainees and elderly people are employed.

All who are interested in "BETTER SEEING" are invited to communicate with :—

MAZDA
Lighting
Advisory Service
THE BRITISH THOMSON-HOUSTON CO. LTD
Crown House, Aldwych, London, W.C.2
Telephone : TEMple Bar 8040

buildings should be provided with gear for raising and lowering, so that they may receive regular attention and cleaning. A simple form of winch will usually enable this to be done with the aid of a shallow false ceiling if necessary.

There is a great need for a simple and cheap design of fitting for domestic use. In bedrooms there is a tendency to put ceiling points where the architect or builder thinks he would put the dressing table—not where the housewife decides, when she comes upon the scene.

Except as regards cost plugs at skirting level form one of the most useful methods of providing light in domestic buildings. The use of silent switches, particularly on light partitions, is also desirable.

Flood Lighting

The flood-lighting of buildings, greatly developed in the years preceding the

war, is a very effective and beautiful method of illuminating architectural work, provided it is done with sympathy and with a careful study of projections and recesses in the façade. Where there is sufficient space around the building, the ideal way, as in Cardiff and Swansea, is to mount the installation on the surrounding grass margins so that the lamps can be removed when not in use. In the case of street buildings, the problem is more difficult and there is room for research in this field.

Very good effects can be obtained with neon lighting when it conforms to the architectural lines of the building. The development of fluorescent lighting after the war has great possibilities, but much remains to be done in the design of these tubes when used with suspended reflectors; no doubt the question of the incorporation of auxiliary equipment in the design will eventually be satisfactorily met.

Ventilation, Heating, Lighting and Seeing*

Pamphlet No. 1, issued by the Industrial Health Research Board of the Medical Research Council, emphasises the importance of these four factors in industry, especially at the present moment when the black-out imposes many difficulties.

The section on "Lighting and Seeing" is illustrated by actual photographs of lighting installations, showing what should and what should not be done. Besides the primary importance of "lighting the job," the value of light surroundings and the judicious use of colour is emphasised. Attention is also drawn to one consideration that is sometimes overlooked—that in order that good lighting may achieve its purpose the eyes must be in a condition to make use of it. Therefore defects of vision should be corrected—indeed, in the case of very close work, even those with normal sight can often benefit from the use of special spectacles.

* Obtainable from His Majesty's Stationery Office; price 3d.

If There's Not a Window — Make One

The psychological effect of some apparent entrance of daylight into a blacked-out interior—even though the actual illumination furnished is relatively small—has often been emphasised. Where little or no daylight is available, imitation with fluorescent lamps will often "do the trick." Thus, in the case of a basement into which daylight cannot penetrate, or where the access of daylight owing to adjacent obstructions is small, the production of an artificial window consisting of diffusing material with fluorescent lamps behind is often most effective—in fact, in some cases people familiar with the building have been known to ask, "However did you get daylight into there?" A case in point is mentioned in a recent note on "Lighting War-Time Emergency Buildings," by Mr. M. C. Hughes (*Osram Bulletin*, October, 1943).



THE EYES HAVE IT.

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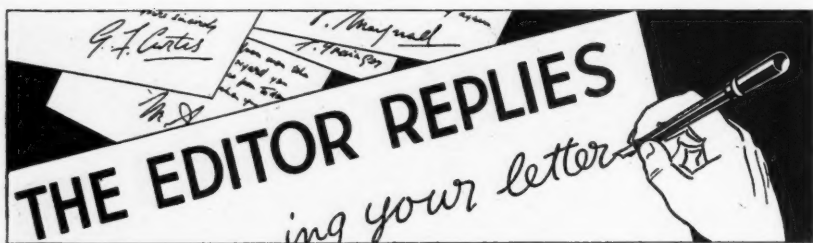
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I am frequently asked questions in regard to **reflector design**—a somewhat complex subject rarely treated at all fully in text books. Firms in the lighting industry, in whose laboratories this problem is closely studied are, quite naturally, not over anxious to reveal their special information.

There are, however, several evident facts that ought to be more generally understood. There is firstly the fundamental difference between "**diffusing**" and "**polished**" reflectors. If a reflector has a mat diffusing surface, no great concentration of light can be expected. We may get a useful aggregate addition to the light given by the source itself in the lower hemisphere, but this is more or less evenly spread. If the interior of the reflector is matt and is uniformly illuminated the additional light reflected in any direction depends simply on the projected area visible. The reflector thus behaves like an illuminated disc and, for a given diameter, its shape does not matter—except in so far as its affects the proportion of the total flux of light enclosed and reflected.

If the reflector is highly polished the possibilities of concentration are much

greater. The brightness of the reflected image of the light source may be only slightly less than that of the source itself, and the greater the number of such images that one can see, looking into the reflector from any direction, the higher the candlepower in that particular direction will be. The smaller the area of the source, the larger the number of images that can be simultaneously seen and the greater the magnification of the candlepower. The extreme case is furnished by a **searchlight**, with a very intense source at the focus of a parabolic reflector, the candlepower of which, within a narrow angle of dispersion, may be magnified thousands of times.

A source of low brightness and extensive area, such as **the fluorescent lamp**, whilst having some very valuable qualities, such as soft shadows and little glare, is naturally not well adapted for the production of concentrated beams of light and parabolic reflectors cannot be used. Even in this case, however, quite a useful magnification can be obtained. Thus with a fluorescent tube approximately 4 centimetres in diameter and a trough reflector of polished interior 20 centimetres wide a magnification of

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about 20/4 or **five times the candlepower of the tube itself**, can be secured.

With **polished reflectors the contour is of great importance**. Thus in the case cited, a magnification of five times the original candlepower is obtained by shaping the reflector in such a way that, in the downward direction, five images of the tube are simultaneously visible.

I have been asked how far **fluorescent "daylight" lamps** can be trusted to give correct results when **colour discrimination is important**. There are, as yet, few scientific data available on this point. I am assured, however, that for ordinary purposes they answer very well—certainly they form the best commercial electric lamp for general use in stores, picture galleries, and places where a general similarity to daylight is all that is needed. For the exacting tests of dyers, however, something more accurate may be desirable. Probably the carbon dioxide tube, or the incandescent lamp equipped with a specially designed filter, are more accurate, though less efficient.

With the fluorescent tubes shades of colour are readily secured, for example, slightly **different qualities of "daylight"** are already offered. In the future it will doubtless be possible to design such lamps specially for colour matching, though possibly at some sacrifice of efficiency.

A distinction should, however, be drawn between the correct representation of colours and **the detection of small stains, faults, or flaws**. This latter purpose is not necessarily best achieved by exact imitation of daylight. A combination of selected colours may be preferable. An interesting case in point has been recently mentioned by Mr. C. A.

Atherton (*Illuminating Engineering*, November, 1943, p. 519). Fluorescent lamps helped considerably in the final inspection of dark leather goods but failed to reveal minute cracks and imperfections in white leather. It was ultimately found that a combination of green lamps in one fitting and pink lamps in another enabled such defects to be detected satisfactorily.

An enterprising safety black-out device is reported from Brighton—an **illuminated sign** for buses bearing the words **"Bus starting,"** displayed prominently over the platform. The sign operates as soon as the conductor presses the signal bell for the driver to start, is automatically extinguished when the bus is in full motion, and remains so until the bus has stopped and is again once more about to start.

This warning device, reported in *Safety News*, is designed to prevent people trying to board buses whilst in motion, sometimes a dangerous process in the black-out, not only because it is less easy to see one's footing, but also because it is difficult to estimate the speed of accelerating vehicles when their outlines are only faintly visible.

It has also been recently stated that the authorities are now willing to allow somewhat **better lighting of the destination boards** of buses, another helpful concession. My attention has been drawn to the extreme difficulty of determining when an approaching taxi is free or not (when one happens to come along). This, however, is not strictly a war problem, for the difficulty has always existed—though doubtless accentuated in present circumstances. Many people, indeed, would confess that the

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difficulty remains in full daylight. The remedy seems to demand some device much more conspicuous than that hitherto applied.

Report of **street accidents** for October again shows a decrease, which is relatively greater in the case of those occurring during hours of darkness. It is indeed remarkable that, whilst, according to *Safety News*, the number of fatal accidents during darkness has **halved** since the beginning of the war (when unprecedented high values were recorded), those happening during daylight have **increased**—despite the reduced number of vehicles on the roads. This only illustrates how difficult it is to take due account of the varied factors involved. The experience noted above is evidently out of accord with the suggestion sometimes made that accidents should be compared in terms of the length of road involved *and* the rate of traffic.

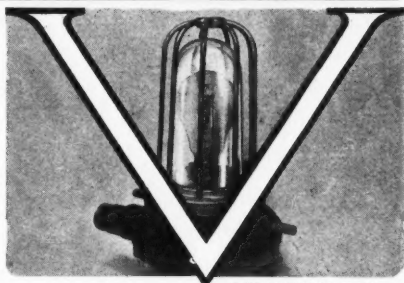


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Continuous Trough Fluorescent Lighting

Continuous trough lighting with fluorescent lamps is becoming increasingly popular, and can be applied in many different situations. The illustration shows the effect in an area devoted to the final inspection of small components—an exacting process—in a large works in the Midlands. The method has been adopted with equal success in the drawing offices at the same works.

In the inspection shop single-lamp troughing with Metrovick 80-watt 5-ft. fluorescent lamps is adopted, whilst in



the drawing office two-lamp troughing (each 5-ft. 5-in. section having two lamps side by side) is used. All fittings are mounted at the maximum height with a view to avoiding the "tunnel effect." In the inspection shop and in the drawing office 20 and 26 ft.c. respectively are provided. Three-phase switching was adopted, adjacent lamps being connected to different phases so as to minimise the stroboscopic effect.

The scheme for the relighting of the whole works, of which the parts mentioned form a relatively small section, was planned by Metropolitan Vickers' engineers.

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Reviews of Books

Fluorescent Lighting Manual. By Charles L. Amick. (McGraw-Hill Book Co., New York and London, 1942; pp. 312, figs. 217.)

A book on this subject is naturally of great interest at the present time. The author (who is associated with Nela Park) naturally deals with American practice. This is possibly an advantage in present circumstances—as is illustrated by the very first illustration showing the *nine* standard sizes of present fluorescent lamps available in the U.S.A., ranging from 6 to 100 watts and varying in length from 9 to 60 inches. The first chapter deals with fluorescent lamps in general terms, explaining their basis of operation, illustrating their main operating characteristics, and showing how the conversion of radiant energy into the visible form is effected by fluorescence. Chapter II. deals with auxiliary equipment and Chapter III. with operating characteristics in fuller detail. Such matters as stroboscopic effect, results of voltage surges, operation on D.C., and effect of surrounding temperature are here considered. Subsequent chapters on "installation hints" and "service suggestions" contain useful practical information, service data being very effectively handled in a tabular summary of defects and suggested remedies. Chapter VI. on "Luminaire Selection" is one of the most useful. The selection of reflectors with a view to modifying light-distribution and the effect of various translucent materials are analysed in detail. This chapter is concluded with a review of different types of design, assessed for quality and field of application. Tables of coefficients of utilisation (assuming uniform lighting over the area considered) are available for these lamps, but distribution of light from individual units and graphs of illumination derived from them at various mounting heights are also presented. A chapter is devoted to colour, in which light-meter correction factors for various light sources are given. Final chapters deal with fluorescent applications and lighting economics. The type is excellent and the book is fully illustrated.

